



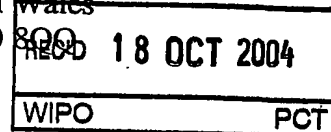
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## 4. Title of the invention

A FLEXIBLE LINER

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-1-

**A FLEXIBLE LINER**

The present invention relates to a flexible liner for an intermediate bulk container. It also relates to an apparatus for emptying such liners.

5 Intermediate bulk containers typically contain an internal liner impermeable to the liner contents. In order to empty such a liner it is typical to firstly seat the liner within a rubber depression. Located at the base of the depression is an aperture which leads to a receiving volume.  
10 As the liner is positioned on the recess it is pierced by a static knife allowing the contents to drain from the liner.

Such a procedure has a number of drawbacks. In particular the seal between the liner and depression is relatively poor allowing the liner contents, particularly  
15 fine powders, to escape to the surrounding air. This can be expensive and depending on the nature of the contents, potentially dangerous.

Similarly, a portion of the liner contents will adhere to the rubber depression rather than falling into the product  
20 receiving volume. Again, such product will be lost. The operator will be exposed to this product when the liner is removed from the membrane.

There have been numerous attempts to overcome such problems. A further known liner comprises a liner bag having  
25 a long entrance/exit sleeve. The sleeve is tied closed and folded between liner and container until it is required to empty the liner. The sleeve is then unfolded and its end untied. A ring is threaded on to the sleeve and the sleeve threaded over a pipe which empties to the product volume.  
30 The ring is connected to the pipe fixing the liner in place. While such an approach minimises product loss during emptying, the operator is exposed to the product whilst fitting the sleeve over the pipe. This fitting procedure is also relatively time consuming.

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Accordingly, in the first aspect the present invention provides a flexible liner for an intermediate bulk container, the liner comprising a liner bag including a discharge outlet defined by a rigid seal.

5       The liner according to the invention has the advantage that the rigid seal can be quickly and easily connected to a corresponding seal in an apparatus for emptying the liner.

      The seal can be adapted to sealingly engage the corresponding seal of an apparatus for emptying a flexible  
10   liner.

      Preferably, the liner further comprises a membrane covering the discharge aperture. The membrane prevents leakage of liner contents until the membrane is removed.

      The membrane can be adapted to be tamper evident. Such  
15   a membrane would provide an indication that the liner bag has not been breached and no airborne contamination has penetrated the liner bag prior to discharging its contents.

      The membrane can releasably cover the discharge aperture and preferably is adapted to be re-attached to the  
20   discharge aperture after release. This has the advantage that when the liner bag is undamaged for removal and disposal the membrane can be used as a re-sealing device to ensure no contamination of the surrounding atmosphere by residual product as the liner bag is removed and disposed.

25       The membrane can comprise at least one tab for pulling the membrane from the discharge aperture.

      The seal can be adapted to sealingly engage the corresponding seal of an apparatus for emptying a flexible  
30   liner.

      The seal can be cylindrical defining a circular discharge aperture. Alternatively the seal can define a square discharge aperture.

      The liner bag can be welded to the seal. This provides a simple and reliable method of connecting the bag and liner.  
35   Alternatively, the liner can further comprise a ring fixing

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the liner bag to the seal. Preferably the ring is snap fit into a corresponding recess in the seal. The ring can be circular in cross section. Alternatively, it can be L shaped in cross section.

5 Preferably the seal is connected to a sleeve portion of the liner bag. The sleeve can be knotted or in some way pinched off between the liner bag volume and seal. This prevents the seal membrane from being exposed to the full weight of the liner contents.

10 The seal can be a metal seal. The liner bag can be plastics material.

In a further aspect of the invention there is provided an apparatus for emptying a flexible liner, the apparatus comprising

15 a seal for engagement with a corresponding seal defining a discharge aperture in the flexible liner;  
a discharge volume in fluid communication with the seal for receiving the contents of the liner; and  
a locking mechanism for locking the apparatus seal and  
20 liner seal into engagement.

Such an apparatus allows rapid spill free emptying of the liner.

The apparatus can further comprise a static knife for piercing the membrane on engagement of the liner seal and  
25 apparatus seal.

By ensuring the membrane is only opened after the seals are engaged spillage is further reduced.

Preferably, the locking mechanism comprises at least two clamps each being adapted to grip a portion of the rims  
30 of the seals maintaining the seals in engagement.

At least one of the clamps can be adapted to be displaced relative to the apparatus seal, preferably by a pneumatic displacement mechanism.

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The apparatus can further comprise a vacuum pump connected to the apparatus seal to educe the air pressure in the liner during emptying.

5 Preferably, at least one of the clamps comprises a second vacuum pump arranged to receive liner contents which escape from between the seal plates.



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## DESCRIPTION

The present invention will now be described by way of example only and not in any limitative sense with reference to the accompanying drawings in which:

5 figures 1(a)-1(d) show a known method of emptying a liner;

figure 2 shows a known liner for use in a further known method of emptying the liner;

10 figure 3 shows a cross-section of the liner according to the invention;

figure 4 shows a membrane covering the discharge aperture of the flexible liner of figure 3;

figure 5 shows the liner of figure 3 connected to an apparatus according to the invention;

15 figure 6 shows the locking mechanism of figure 5 in planar view;

figure 7 and 8 show seals of alternative embodiments of liners according to the invention.

20 Figure 1 shows a cross-section of an intermediate bulk container (1) suspended from a rigging frame (2) by loops (3). Positioned within the container (1) is a liner (4) for a product (not shown).

25 The liner (4) is closed by a liner knot (5). This is in turn connected to a line tensioning mechanism (6) which keeps the liner (4) under tension during the emptying procedure.

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As shown in figure 1(b), the liner (4) is positioned on a rubber membrane (7). At the base of the membrane (7) is an aperture (8) which leads to a receiving volume (not shown) for receiving the liner contents.

5 Extending from the aperture (8) is a stationary knife (9) arranged to pierce the liner (4) as it is lowered on to the membrane (7). As shown, after piercing the majority of the liner contents fall through the aperture (8) to the receiving volume.

10 As the weight of product within the liner (4) decreases the tensioning mechanism (6) lifts the liner sidewalls as shown in figures 1(c) and 1(d). This allows the remaining product to fall into the aperture (8).

Such a known method and apparatus has a number of  
15 drawbacks. In particular the seal between the liner (4) and membrane (7) is relatively poor allowing the liner contents to escape to the surrounding air. Contents also adhere to the membrane (7). The operator is exposed to these when the liner (4) is removed.

20 Shown in figure 2 is an alternative known liner (9). The liner (9) comprises a main liner volume (10) and an exit sleeve (11). In use the exit sleeve (11) is knotted or clamped in some way to close the liner. To empty the liner (9) the sleeve (11) is unknotted and positioned over a tube  
25 leading to a receiving volume. The sleeve (11) is attached to the tube by a ring threaded over the sleeve (11). The ring is fitted over the tube sandwiching the liner (9) between ring and tube.

The use of such a liner (9) also has a number of  
30 drawbacks. The connection procedure is relatively time consuming. In addition traces of liner contents in the sleeve (11) below the ring will fall to the outside of the tube and enter into the surrounding atmosphere.

Shown in figure 3 is a liner (12) according to the  
35 invention. The liner (12) comprises a liner bag (13) and a

-7-

seal (14). The bag (13) includes an aperture the edge of which is connected to the seal (14) to form a discharge aperture (15). In this embodiment the liner (12) is welded to the seal (14). The seal (14) comprises a collar (16) attached to the liner (12) with a lip (17) of increased radius. The lip (17) defines a flat sealing surface (18).

A membrane (19) extends across the discharge aperture (15) as shown in figure 4. The membrane (19) includes a number of tabs (20) for tearing the membrane (19) from the discharge aperture (15).

In order to empty the liner (12) according to the invention the membrane (19) is firstly torn from the discharge aperture (15). The liner seal (14) is then placed on a corresponding apparatus seal (21) of an apparatus for emptying the liner as shown in figure 5.

A locking mechanism (22) comprising clamps (23) each attached to a pneumatic cylinder (24) is activated by the operator. Each pneumatic cylinder (24) urges its corresponding clamp (23) into engagement with the liner and apparatus seals (14, 21) as shown in the enlarged portion of figure 5. Each clamp (23) includes a recess (25) which engages with a corresponding projection formed by the lips of the liner and apparatus seals so as to urge the seals (14, 21) together.

A restriction in the sleeve (26) is then released allowing the liner contents to pass along the sleeve (26) and through the discharge aperture (15) into a product volume (not shown) of the apparatus. The emptying apparatus includes a vacuum pump (27) in fluid communication with the seal (14, 21). Once the majority of the product has fallen into the product volume the vacuum pump (27) is used to remove the remaining traces of product from the liner (12). The vacuum pump (27) also deflates the liner (12) making it easier to fold.

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Extending through each clamp (23) is a conduit (28). The conduit (28) extends from close to the join between the seal to a point remote from the seals. The conduit (28) is connected to a second vacuum pump (29) which receives liner contents which escape from between the seals (14, 21) during the emptying procedure.

Figure 6 shows the clamps and conduits in plan view.

Shown in figure 7 is a seal (30) of a further embodiment of a liner according to the invention. In order to attach the liner bag (12) to the seal (30) the liner bag (12) is wrapped around a ring seal (31). The ring seal (31) is snap fit into a recess (32) and the seal proximate to the flat sealing surface (18). The ring seal (31) is circular in cross section as shown.

Figure 8 shows a seal (33) of a further embodiment of a liner according to the invention. Again, the liner is attached to the seal (33) by means of a ring seal (31) which is snap fit to the liner seal. In this embodiment the ring seal (31) is L shaped in cross section.

In an alternative embodiment of the invention (not shown) the apparatus for emptying the liner includes a fixed blade which pierces the membrane when the liner seal is placed on the apparatus seal.

In this embodiment of the invention the seals are metal whilst the liner bag is of plastics material.

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## ABSTRACT

A flexible liner for an intermediate bulk container, the liner comprising a liner bag including a discharge outlet defined by a rigid seal.

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**CLAIMS**

1. A flexible liner for an intermediate bulk container, the liner comprising a liner bag including a discharge outlet defined by a rigid seal.

5 2. A flexible liner as claimed in claim 1, wherein the seal is adapted to sealingly engage with a corresponding seal of an apparatus for emptying a flexible liner.

3. A flexible liner as claimed in either of claims 1 or 2, further comprising a membrane covering the discharge  
10 aperture.

4. A flexible liner as claimed in claim 3, wherein the membrane releasably covers the discharge aperture.

5. A flexible liner as claimed in claim 4, wherein the membrane comprises at least one tab for pulling the membrane  
15 from the seal.

6. A flexible liner as claimed in either of claims 4 and 5, wherein the membrane is adapted to be re-attached to the discharge aperture after release.

7. A flexible liner as claimed in any one of claims 1 or 6, wherein the seal is cylindrical defining a circular  
20 discharge aperture.

8. A flexible liner as claimed in any one of claims 1 or 6, wherein the seal defines a square discharge aperture.

9. A flexible liner as claimed in any one of claims 1 to 8, wherein the liner bag is welded to the seal.  
25

## -II-

10. A flexible liner as claimed in any one of claims 1 to 8, further comprising a ring fixing the liner bag to the seal.

11. A flexible liner as claimed in claim 10, wherein the ring is snap fit in a corresponding recess in the seal.

12. A flexible liner as claimed in any one of claims 1 to 11, wherein the seal is a metal seal.

13. A flexible liner as claimed in any one of claims 1 to 12, wherein the liner bag is a plastics material.

14. A flexible liner as claimed in any one of claims 1 to 13, wherein the seal is connected to a sleeve portion of the liner bag.

15. An apparatus for emptying a flexible liner, the apparatus comprising  
a seal for engagement with a corresponding seal defining a discharge aperture in the flexible liner;  
a discharge volume in fluid communication with the seal for receiving the contents of the liner; and  
a locking mechanism for locking the apparatus seal and liner seal into engagement.

16. An apparatus as claimed in claim 15 further comprising a static knife for piercing the membrane on engagement of the liner seal and apparatus seal.

17. An apparatus as claimed in either of claims 15 or 16, wherein the locking mechanism comprises at least two clamps each being adapted to grip a portion of the rims of the seals maintaining the seals in engagement.

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18. An apparatus as claimed in claim 17, wherein at least one clamp is adapted to be displaced relative to the apparatus seal.

5 19. An apparatus as claimed in claim 17, wherein at least one clamp is adapted to be displaced by a pneumatic displacement mechanism.

10 20. An apparatus as claimed in any one of claims 15 to 19, further comprising a vacuum pump connected to the apparatus seal to educe the air pressure in the liner during emptying.

21. An apparatus as claimed in any one of claims 15 to 20, wherein at least one of the clamps comprises a second vacuum pump arranged to receive liner contents which escape from between the seal plates.



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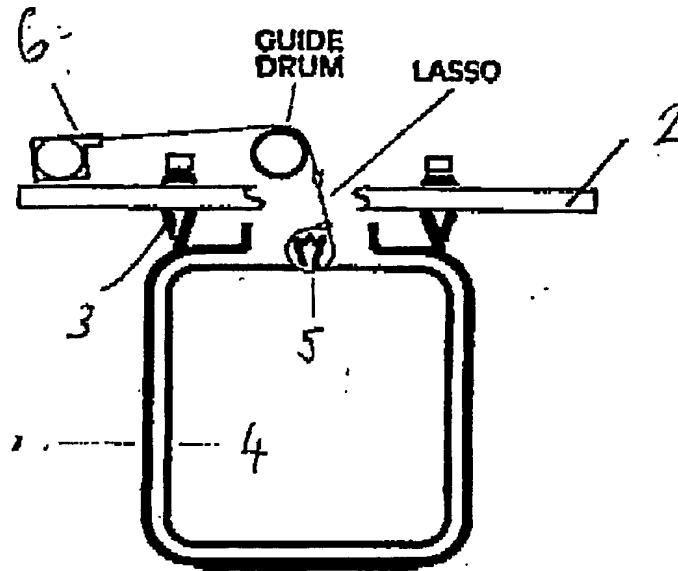


figure 1(a)

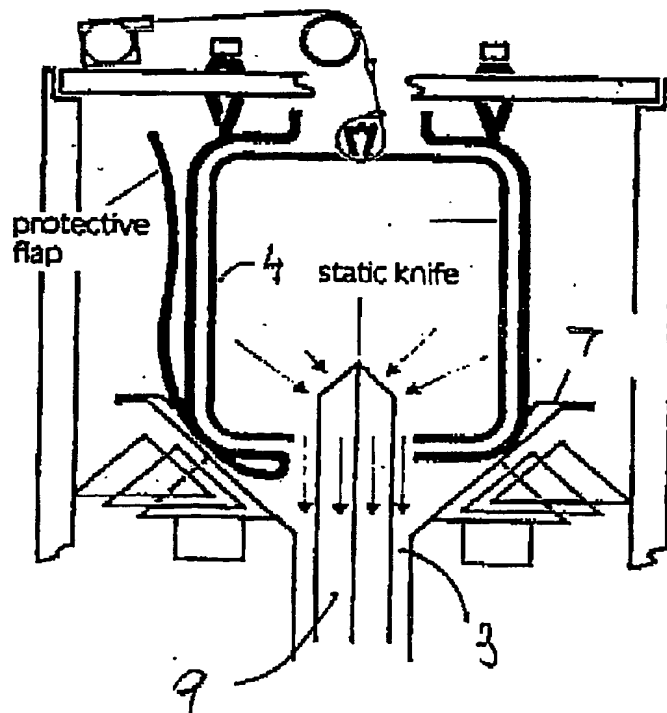


figure 1(b)

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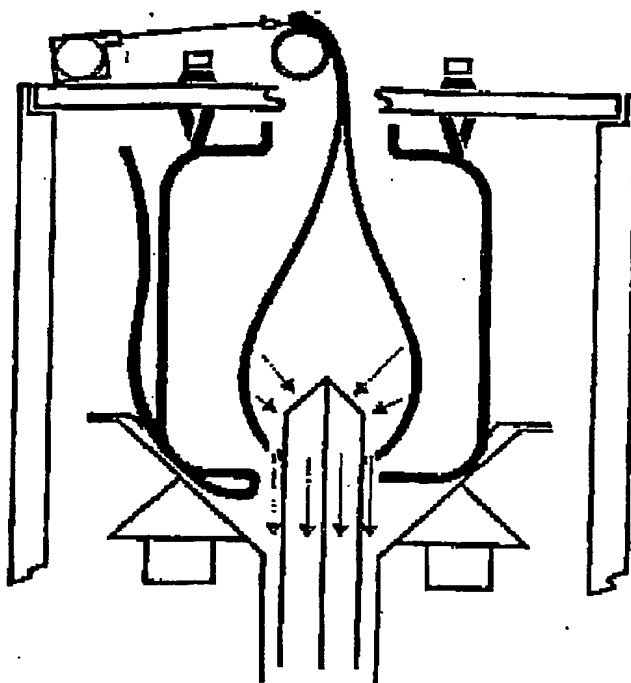


figure 1(c)

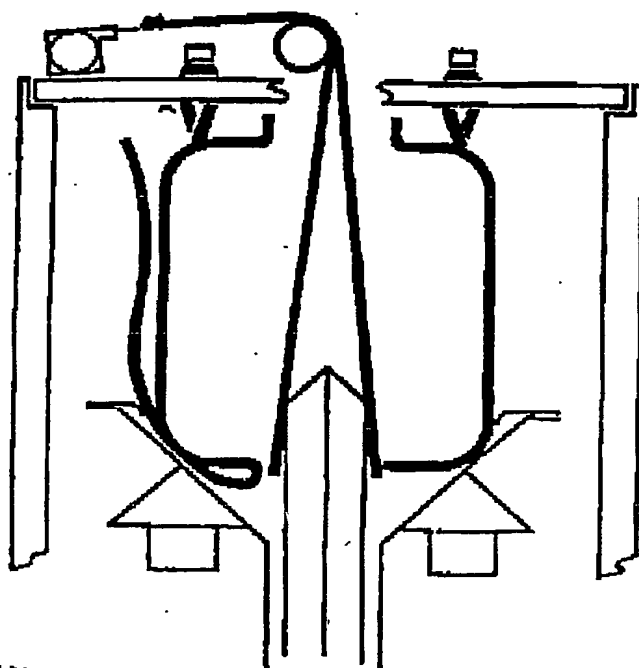


figure 1(d)

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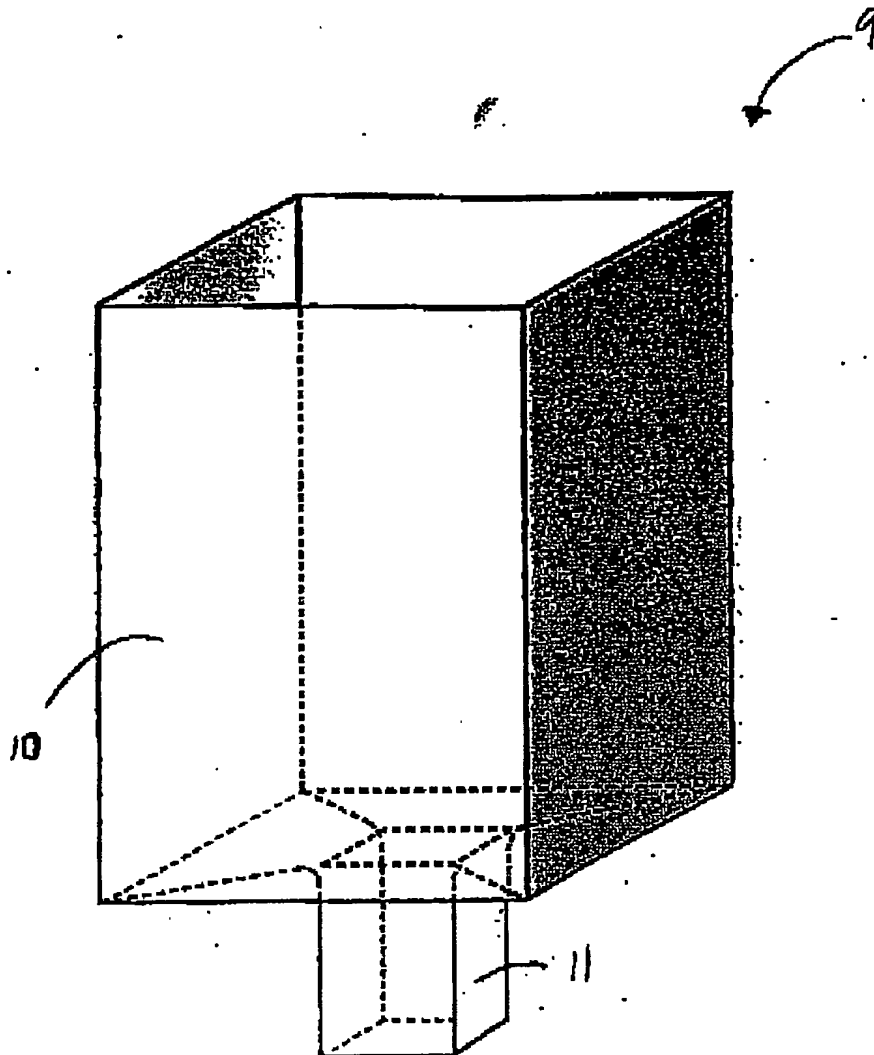


Figure 2

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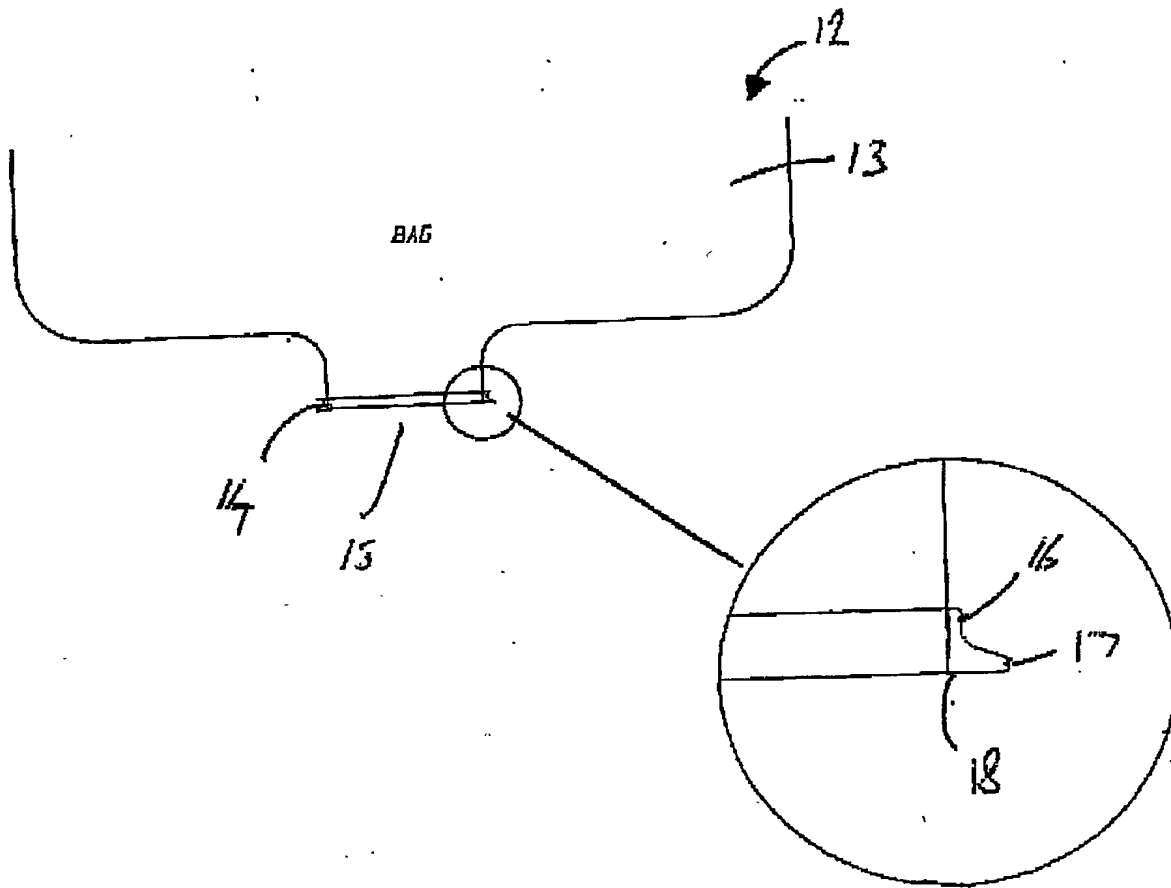


figure 3

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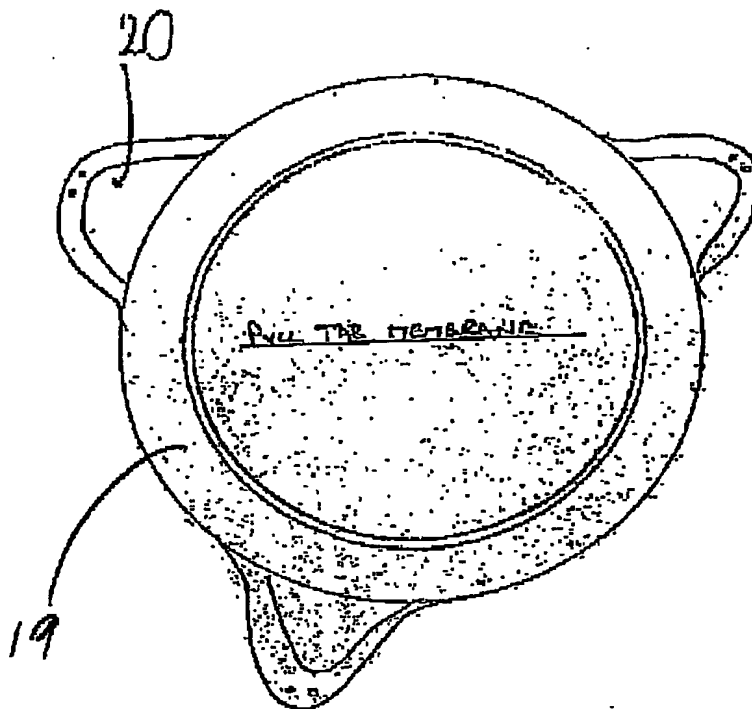
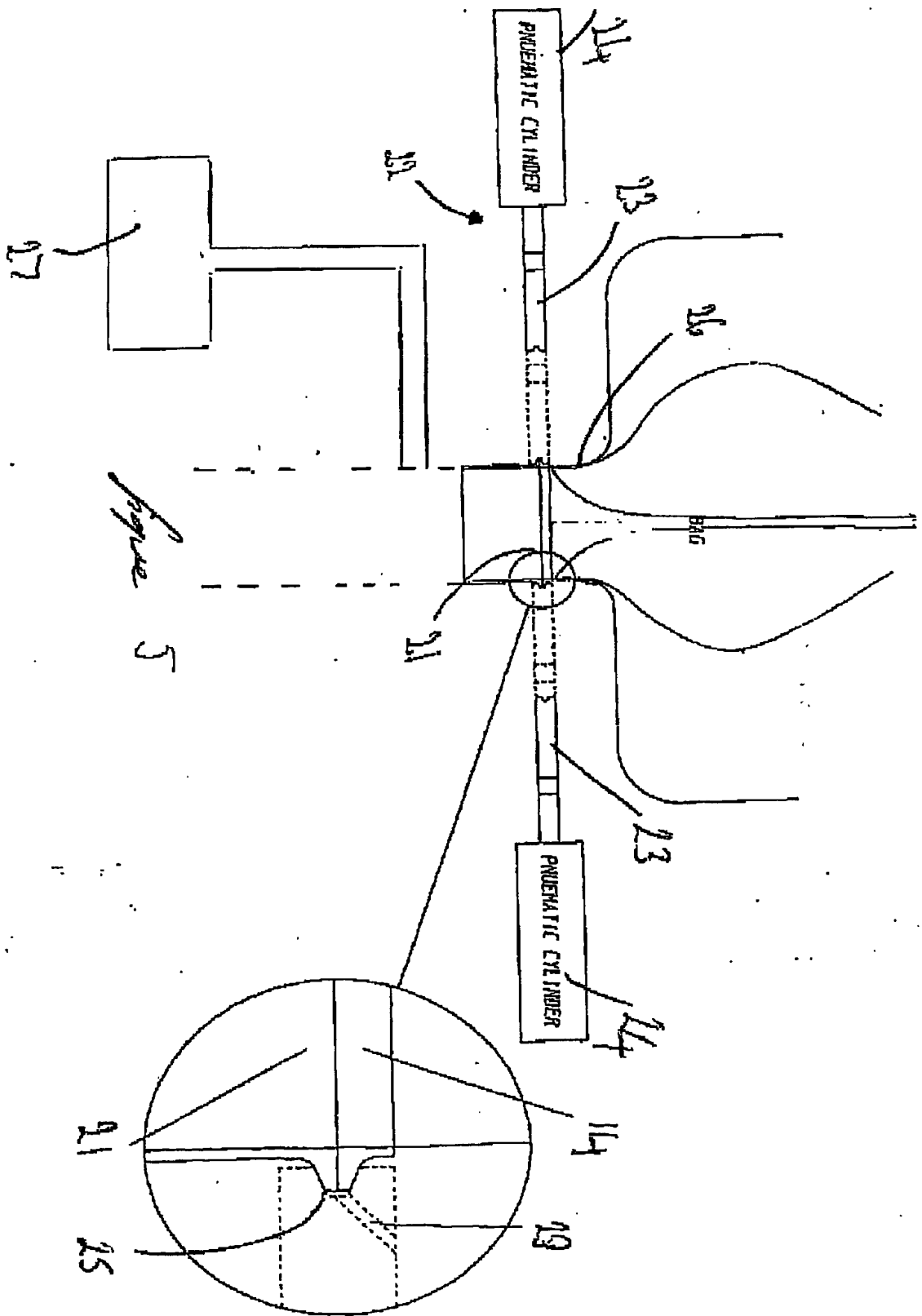


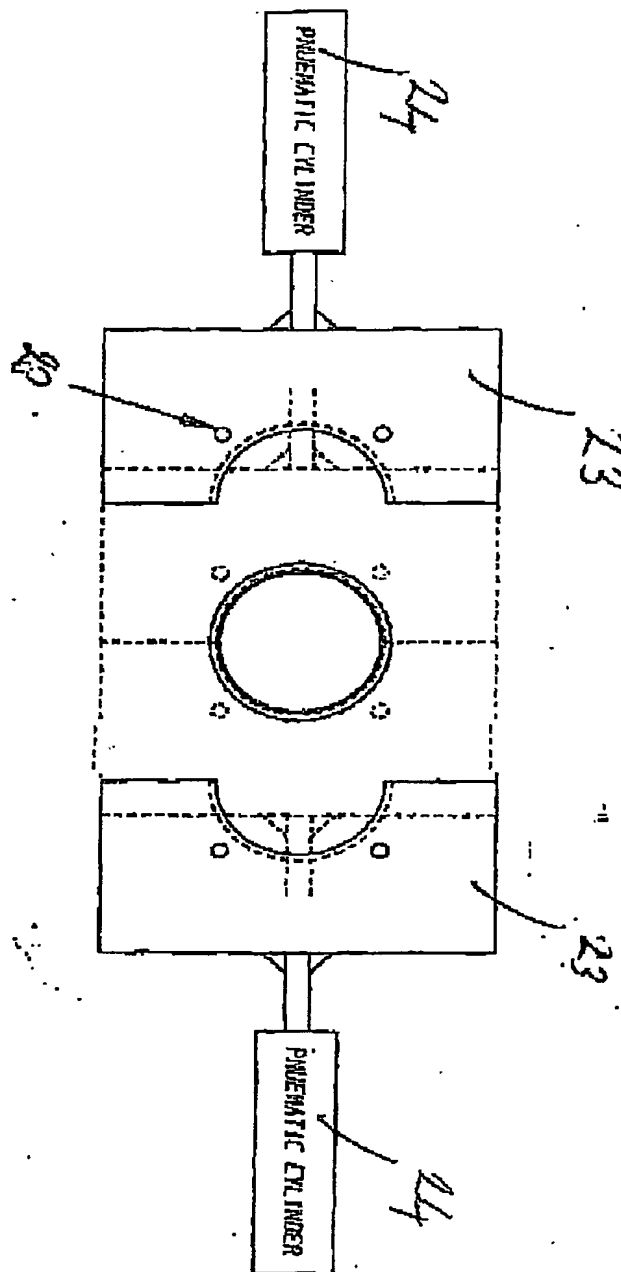
Figure 4

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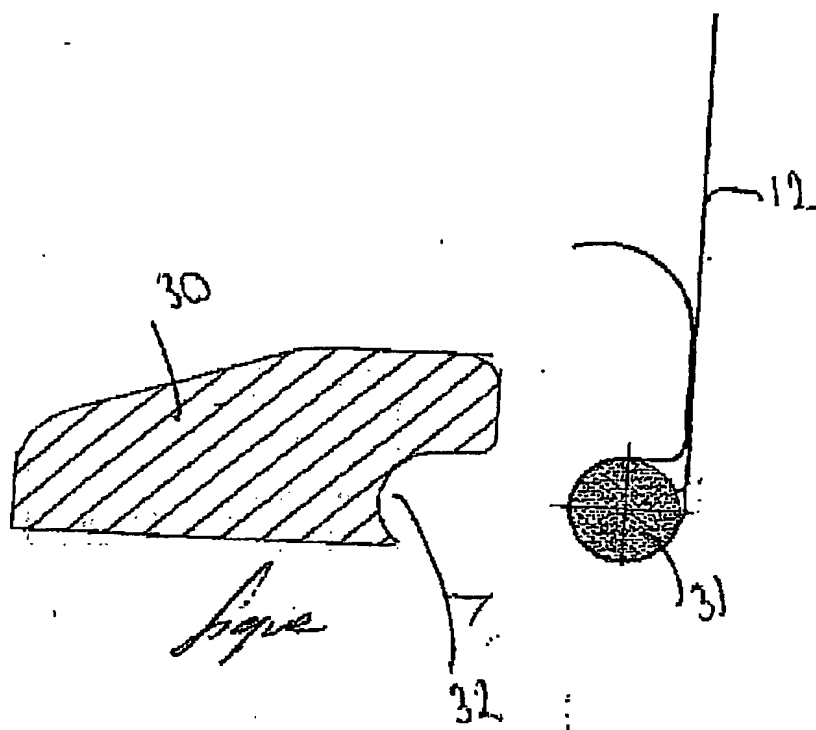


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figure 6



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figure

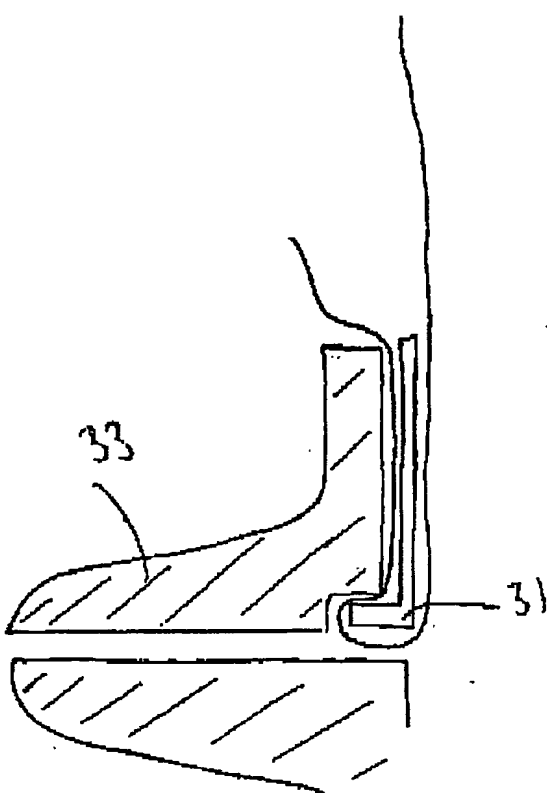


figure 8



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